THE PICTS.

By Rev. Neil MacNish, B.D., LL.D.

(Read 10th April, 1897).

The question, Who the Picts were, and what the language was which they spoke, still continues to evoke attentive interest. Mr. Nicholson, Bodley's Librarian in the University of Oxford, published about a year ago, a little book to which he has given the designation: "The Vernacular Inscriptions of the Ancient Kingdom of Alban." His aim is to prove, and he has been very successful in establishing his contention, that the Pictish Inscriptions which he has examined and deciphered, indicate that Gaelic was the language of the Picts. He is correct in stating that three theories have been held with regard to the language of the Picts. It has been maintained that that language is closely akin to Irish and Scottish Gaelic It has also been contended that it has a strange resemblance to the Cymric branches of the Celtic language. Further, there are those who are of the opinion that the language of the Picts is neither Celtic nor even Aryan, but that it has a strong likeness to the language of the Basques. It is unfortunate that no literary remains of any description have come down to our time from the period in the history of the Picts which preceded their union with the Scots in 844, to form henceforth one kingdom. It is with the sculptured stones of the Picts that Mr. Nicholson concerns himself. He avers that there are eighteen Inscriptions, that they are all cut on stones, that several of them are now in the National Museum of Antiquities, Edinburgh, and that with three exceptions they are written in Ogam letters. Professor Rhys of Oxford, who has devoted great pains on the decipherments of Pictish Inscriptions, advances the conjecture that the Ogam characters were invented by a "Goidelic native of Siluria or Demetia, who having acquired a knowledge of the Roman alphabet and some practice in a simple system of scoring numbers, elaborated the latter into an alphabet of his own, fitted for cutting on stone and wood." The Ogam alphabet is confined to the British Isles. No Ogam Inscriptions are found elsewhere. Numerous Inscriptions in that character have been discovered in Ireland, in portions of Scotland, including the Shetland and Orkney Isles, in the Isle of Man, in Wales and in England. In the Book of

Ballymote, which was compiled towards the close of the fourteenth century, and which is now in the Library of the Royal Irish Academy, there is a special tract wherein the different styles of Ogamic writing and the value of the letters are explained. Whether Mr. Nicholson received any material assistance from the tract in the Book of Ballymote in his laudable determination to interpret the Pictish inscriptions or not, it is quite manifest that he has brought great ability and acumen and industry to bear in the interpretation of those strange Inscriptions. He has constructed an alphabet in Ogam characters, consisting as it does of "strokes—almost exclusively straight strokes—written in a line commonly called the stem-line, which is normally straight." Mr. Nicholson is well aware that, as he has not inserted in his book a photograph of every Inscription to which he refers, or of which he gives an interpretation, he cannot expect as ready an appreciation of his labours and as extensive an acquiescence in his deductions on the part of competent scholars, as would undoubtedly be the case, were every intelligent reader of his book enabled to compare for himself the Ogam Inscriptions with the explanation of them which he has been successful in discovering and which he accordingly communicates. He assigns certain reasons which have prevented him from publishing photographs and fac-similes of the Inscriptions which he has undertaken to decipher and explain. It is evident that Professor Rhys, whose scholarship is well-known, is in active sympathy with Mr. Nicholson in a common desire to shed all the light that may be possible for them, on these curious Ogam Inscriptions that connect us in a certain sense with a past which, however interesting it may be for many reasons, has few trustworthy records whereby an acquaintance with its peoples and doings and political circumstances can be obtained by us. It does great credit to Mr. Nicholson that he has studied carefully the best authorities that are available for understanding the few specimens of early Celtic literature which have been transmitted to us from the early centuries of the Christian era. He has made himself familiar with Zeuss' Grammatica Celtica and with the Goidelica and other books which Whitely Stokes has edited. There is no exaggeration in the praise which Ebel, the editor of the second edition of the Grammatica Celtica bestows on those two great Celtic scholars : " Post ipsum conditorem ac parentem grammaticæ Celticæ haud facile quisquam invenietur, qui melius meritus sit de omnibus hujus doctrinæ partibus quam Whitleius Stokes." Mr. Nicholson has conclusively shown that the language of these Pictish Inscriptions is Gaelic, and that so far as the argument which is thus available is concerned, it goes to uphold the theory that the Picts were Gaels, and that their language was Gaelic. He does not overstate the value of his interpretation of the

Pictish Inscriptions when he remarks : "But that the language of those inscriptions is simply old Gaelic is a fact which will not henceforth be doubted by any Keltic scholar who reads this book," etc.

It has been wisely asserted, that "it is a long time ago since the first Celts crossed the sea to settle in Britain. Nobody knows how long, and the guesses which have been made as to the date are hardly worth recording. And when they did come, the immigration was not all over in one year or even in one century. The Goidels were undoubtedly the first Celts to come to Britain, as their geographical position to the west and north of the others would indicate, as well as the fact that no trace of them on the Continent can now be identified. They had probably been here for centuries when the Brythons or Gauls came and drove them westward. The Goidels had done the same with another people, for when they came, they did not find the country without inhabitants. Thus we get at least three peoples to deal with—two Celtic and one pre-Celtic."

In his Life of Agricola, Tacitus thus writes ; "Namque rutilæ Caledoniam habitantium comæ. . . . Silurum colorati vultus, et torti plerumque crines, et posita contra Hispania, Iberos veteres trajecisse easque sedes occupasse, fidem faciunt." Isaac Taylor has the authority of Tacitus on his side when, in his Origin of the Aryans, he thus writes, (p. 76) : "There can be little doubt that the Iberian race was dark in complexion, with black hair and eyes. As to the Celtic race, it is almost certain that they were fair with red or yellow hair and blue or blue-grey eyes. The Iberians were plainly the primitive inhabitants of Britain. The Celts were later invaders who were not only a more powerful race but possessed a higher civilization. The Iberians extended over the whole Spanish peninsula as well as over the coasts and islands of the Mediterranean. The Celts when they invaded Britain, found the country in possession of the Silurian race whose descendants can be traced to Denbighshire and Kerry."

The account which Bede gives in his Ecclesiastical History of the Inhabitants of Great Britain and Ireland, possesses a peculiar importance. "This island at present contains four nations—the English, Britons, Picts and Latins. At first this island had no other inhabitants but the Britons. The nation of the Picts from Scythia arrived in the northern coasts of Ireland, and desired to have a place granted them in which they might settle. Acting on the advice of the Scots who occupied Ireland, the Picts sailed over to Britain and began to inhabit the northern parts thereof. In process of time Britain, besides the Britons and the Picts,

received a third nation, the Scots, who migrating from Ireland under their leader Reuda . . . secured to themselves those settlements among the Picts which they still possess. From the name of their commander they are to this day called Dalreudius, for in their language Dal signifies a part." It is added in a footnote: "Hence Dalrieta or Dalreuda may be explained Dal-Ri-Eta, the portion of Reuda or Rieta, *i.e.*, King Eta."

In his De Bello Gallico, L. 5, Cæsar thus writes: "Omnes vero se Britanni vitro inficiunt quod cæruleum efficit colorem atque hoc horridiore in pugna aspectu." We may infer on the authority of Cæsar that the inhabitants of Britain in his time painted themselves with a dye that they extracted from woad. The designation *Picti* or painted men, would thus be applicable to all the tribes of Britain of whom Cæsar had any knowledge. It was about the year 360 A.D., that those who were subsequently known as the *Picts* of Scotland received the distinctive appellation of *Picts* to distinguish them from the Scoti or Scotti. In his Dissertation on the Poems of Ossian, MacPherson contends that it is absurd to suppose, that the name of Picts was given by the Romans to the Caledonians, who possessed the east coast of Scotland, from their painting their bodies. According to MacPherson, "Britons who fled northward from the tyranny of the Romans, introduced painting among the Picts. Owing to that circumstance, it has been held that the Picts were thus designated for the purpose of distinguishing them from the Scots who never had that art among them, as well as from the Britons, who discontinued it after the Roman conquest." The Picts called themselves Cruithne. Their original settlements appear to have been in the Orkneys, the north of Scotland, and the north coast of Ireland or the modern counties of Antrim and Down. A certain writer affirms that the Scots came originally to Ireland, one of whose names from the sixth to the thirteenth century was Scotia. It was called Scotia Major, after part of northern Britain had acquired in the eleventh century the same name. The transfer of the name Scotia to what is now known as Scotland was ultimately due to the rise and progress of the tribe called Dalriad, which migrated from Dalriada in the north of Antrim to Argyll and the isles in the beginning of the sixth century. A difference of opinion obtains as to whether the habit of painting their bodies prevailed among the Scoti of Ireland as well as among the Picts of Scotland. Cruithne or Cruithing involves the root Cruth which signifies form. Cruithneachd, the Gaelic word for wheat can easily be regarded as compounded of *Cruth* form and *sneachd* snow, the word thus signifying etymologically the form or appearance of snow, out of regard, doubtless, to the whiteness of the flour which is extracted from wheat. Professor Rhys, with

apparent correctness, derives Cruithing and Prydd from Cruth and Pryd respectively, which mean form, and as Duald MacFirbis believes, "a people who painted the forms (Crotha) of beasts, birds and fishes on their faces, and not on their faces only, but on the whole of the body."

Scoti was supposed to be identical with Scuit or sguit, a wanderer, and therefore to indicate the erratic life or nomadic life which the Scots pursued. An ingenious etymology has recently been advanced which finds the true explanation of Scoti in the Welsh word ysgwthr, a cutting or carving, and ysgythru, to cut or prune. Examples occur, it is maintained, where the Welsh word means to dye or to paint. If that derivation be adopted, the term Scoti or Scotti would mean painted men, or at least, those who were cut or scarred. The Scoti were largely confined to Antrim and Down in the north of Ireland. The Scoti crossed over from that portion of Ireland, and founded in Argyllshire the Kingdom of Dalriada, Dal Riada, or Righ Fhada. Fergus, the son of Erc, with two of his brothers, led the colony of the Dalriads into Argyllshire and founded the Scottish monarchy there in 503 A. D. His successor was his son, Domangart, who was followed by his son Comgal, the father of Conal that gave the Island of Iona to St. Columba. The Scoti in Dalriada were separated from the northern Picts by Drumalban, the Dorsum Britanniæ. The southern Picts occupied the eastern portion of Scotland from the Firth of Forth towards Aberdeen and the Grampians. The inference can be drawn from the Anglo-Saxon Chronicle that the Picts were warlike and powerful. "In 443 A.D., the Britons sent over the sea to Rome and begged for help against the Picts. In 449 A.D., Vortigern, king of the Britons, gave land to Hengist and Horsa on condition that they should fight against the Picts. In 565 A.D., Columba, a mass priest, came to the Picts and converted them to the faith of Christ. They are dwellers by the northern mountains. And their king gave him the island which is called Ii. In 681 Tumbert was consecrated Bishop of Hexham and Trumwine of the Picts; for at that time they were subject to this country." Columba, himself a descendant of Niall of the nine hostages, was nearly related to the royal family of the Scoti of Dalriada, and was instrumental in placing Ædan, the great-grandson of Fergus Mac Erc, on the throne. These statements are made by Bede in his Ecclesiastical History regarding St. Columba: "In 565, Columba came into Britain to preach the word of God to the provinces of the northern Picts, who are separated from the southern parts by steep and rugged mountains. The southern Picts, who dwell on this side of those mountains, had long before embraced the truth by the preaching of Ninias. Columba came into Britain in the ninth year

of the reign of Bridius, who was the son of Meilochon and the powerful king of the Pictish nation, and he converted that nation to the faith of Christ by his preaching and example; whereupon he also received of them the aforesaid island for a monastery. Now, Columba was the first teacher of Christianity to the Picts beyond the mountains northward and the founder of the monastery in the island Hii which was for a long time much honoured by many tribes of the Scots and Picts." It is said that the dominion of Brude or Bridus extended from the Forth to the extremity of Caithness and the Orkneys. Brude died in 586, having reigned thirty-eight years. His successor Garnard and all the following kings of the Picts were Christians. Columba founded many monasteries in Ireland. He was the teacher of the British Scots and the apostle of the northern Picts. He became the chief ruler both of the Scottish and Pictish church and at the same time exercised great authority in Ireland.

The Book of Deer possesses a unique importance in Gaelic literature. It was discovered and secured by Bishop Moore of Norwich, whose library was presented to the University of Cambridge some hundred and fifty years ago. The Librarian of that University found it in the library, and through him it was brought to the knowledge of the literary world. In addition to its other contents, it has an account of the foundation of the old monastery of Deer. An edition of the Gaelic portions at least of the book has been published by the Spalding Club, under the able supervision of Dr. John Stuart. Whitley Stokes, in his Goidelica, gives a translation of the six Gaelic entries in the book, believing as he does that the philological value of the book lies in the Gaelic portions of it. The first sentence of the entry that narrates how the monastery was founded, is to this effect: "Columcille agus Drostan mac cosgreg adalta tangator ahi marroalseg dia doibh gonic abbordoboir agus bede Cruthnec, robo mormaer buchan araginn agus efse rothidnaig doibh ingattirag sain insaere gobraith o mormaer agus o thosec," *i.e.*, Columcille and Drostan, son of Cosgrach, his pupil, came from Hi (Iona) as God had shown to them, to Aberdeen; and Bede, the Pict, was grand steward (or Mormaor) of Buchan before them; and it was he that gave them that town in freedom for ever from Mormaor and toiseach."

The Gaelic which the Book of Deer contains is unmistakably the Gaelic of the Highlands of Scotland. It is difficult to determine with accuracy where the book in question was written. At any rate, whether it was written in the ninth century or not later than the twelfth century, it must be regarded as setting forth the tradition in reference to the founding of the monastery of Deer. In his elaborate work, *Celtic Scotland*, Skene traces the gradual growth and subsequent power and

importance, of these officials who are mentioned under the appellation of Mormaor or grand steward and toiseach or chieftain. No valid reason is available to dispute the accuracy and consequent reliability of the tradition that St. Columba and Drostan founded the monastery of Deer in the manner which is detailed in the book. The language, though partaking of the peculiarities which attach to all the oldest specimens of Gaelic that are extant, is purely Gaelic, and, as the book purports to give and reproduce the very words of Columba, *e.g.*, "Rolaboir Columcille bedear ainm o huun imace," the inference is plausible enough that Gaelic was the language which Bede, the Pict, and the Picts spoke who resided in that part of Scotland, and with whom, in virtue of his position as Marmaor, he had intimate relationship. Cruithne, the ordinary term which was applied to the Picts in the sixth and subsequent centuries, is in the Book of Deer applied to Bede, the Mormaor, who made a present of the town to Columba. The fact that certain proper names occur in the Gaelic portions of the book, which are not known otherwise in Gaelic nomenclature, does not invalidate the argument which can be deduced in favour of the contention, that the language of the northern Picts, who were contemporary with St. Columba, was Gaelic, identical with the language which the Gaels of Scotland have always spoken. Than Skene, the talented and painstaking author of Celtic Scotland, no one can speak with greater authority in connection with all questions affecting the Picts and Scots. His emphatic language is: "We cannot point to any spoken language in the island which can be held to represent Pictish as a distinctive dialect. The Cruithnigh to the beginning of the seventh century, formed with the Picts of Scotland, one nation. During the whole of their separate existence, the Irish annals do not contain a hint that they spoke a language different from the rest of Ireland."

It is unnecessary to follow the political fortunes of the Dalriads and the Picts, until they were united to form one kingdom under Kenneth MacAlpine in 844. It has been reasonably held, that the union of the Picts and Scots under one sovereign formed an important era in the history of Scotland. The whole of Scotland, north of the Firths of Forth and Clyde, was welded into one kingdom which was never afterwards broken up into separate principalities. The life of the Scottish court flowed on amid many diversities of fortune, and Gaelic continued to be the language of the court until the reign of Malcolm Canmore, who married the Anglo-Saxon Princess Margaret in 1070, and transferred the court and capital from Scone to Dunfermline, thereby terminating the honourable position which the Gaelic language hitherto possessed as the

language of the kings and queens of Scotland. Malcolm had little or no education. He acted as interpreter between Queen Margaret and his Gaelic subjects, seeing that he was able to converse with equal facility in English and in Gaelic. It is with some Gaelic elements of sadness to be admitted, that the reign of Malcolm was in reality the commencement of a revolution in the language and people as well as in the laws and manners of northern Britain. The Albanic Duan is an important relic of Gaelic literature. It is to be found in the Chronicles of the Picts and Scots. It is supposed to have been taken from the MacFirbes MS. in the Royal Irish Academy. It is said to have been sung by the Gaelic bard of the royal house at the coronation of Malcolm Canmore. It narrates in detail the names of those who preceded Malcolm in the kingly office in Albion. It is the oldest and most authentic record of the Scottish kings. Its Gaelic is very similar to that of the Book of Deer. This reference to the Cruithne occurs in it :

Cruithnigh ros gabhsad iarrtam,
Tar ttiachtain a h-Erean mhuigh.
X righ tri fichid righ ran.
Gabhsad diobh an Cruithean chlar.

The Cruithne took it (i.e. the land of Alban) after that
On coming out of Erin of the plain,
Seventy noble kings of them
Took the Cruithnean plaid.

May not the consideration that the Albanic Duan, setting forth as it does the genealogy and names of the kings of Scotland, is written in Gaelic, lead of itself to the strong presumption that all the kings, whose names and lineage are mentioned spoke Gaelic, and that Gaelic was the language of their court and people down to the time of Malcolm Canmore ?

Pictish words survive, that reveal their Gaelic lineage at a glance. Much used to be made of Peanfahel which Bede mentions as being the name of Abercurnig (Abercorn), in the Pictish language.

Peanfahel can readily take on a Gaelic garb, and appear as Ceann â bhalla or the head of the wall. P and c are convertible letters in Gaelic, and so are b and f ; and such being the case, there is no reason whatever for hesitating to regard Peanfahel as a purely Gaelic word. Such Pictish words as Bede, Bred, Brude, Canaul, Cartit, Cruithneach, Ceannaleph, indicate a very close affinity, if not an absolute identity, with the normal Gaelic of Albion. Ceannfota is Ceannfada or long head ; Cinnoch cinic, is Cinneach tribe or nation : Donnel Domhnull is Donald ;

Domelch Domnach is Domhnach, Sunday; Elfin is Alpin Alp fhonn, the country of the hills; Fingean appears, in MacKinnon, MacFhingein. Flocaid, Fodla, Atholl, Atth Fodhla, the ford of Fodhla; Fodhla was an ancient name of Ireland. Loc is laoch, a hero; Mailcun is Maoilchon, the servant of Conn; Nectan appears, in MacNaughton; Onnist and Unnist appear in Aonghas, Angus; Scolofthe appears in Sgalag, a farm-servant. Salen is to be found in Salen, a topographical word in the Island of Mull, Argyllshire, which means Sail fhonn, or the land or place of the salt water. Uven seems to find its counterpart or equivalent in Eoghann, the Gaelic word for Hugh or Evan. Were it possible to discover many more words of an unmistakably Pictish character, it may, with no small assurance, be presumed that they would reveal a much closer similarity to Gaelic than to Welsh, or to any other language whatsoever. Who, then, were the Picts, and what was the language which they spoke? They belonged undoubtedly to the Gaels or Goidels, who were the first among the Celts to come from the Continent of Europe into what is now known as Great Britain and Ireland. There is no evidence that is worthy of any serious consideration, to prove, that they belonged to a later invasion, and that their appearance in Albion is to be traced to a much later date than that of the Gaels and Cymru. Rather it is to be asserted with no feeble certainty, that the Picts of Scotland are to be regarded as the descendants and representatives of the earliest Gaels who entered Albion and who absorbed or incorporated with themselves whatever people, if any, whether Iberian or otherwise, who preceded them in the occupation of Albion during the infantile days of human immigration. The brave Caledonians who, under the leadership of Galgacus, fought against the Romans under Agricola, might with abundant propriety have borne the designation Picts as well as Caledonians. No better etymology can be advanced for Caledonia than Dun nan Gaidheal, or the hill or fortification of the Gaels, a name which is perpetuated in Dunkeld. Scholars from whom better things might, in all reasonableness be expected, have allowed themselves to be confused and led astray by separate names, by means of which, whether with or without reason, a people that was virtually one and the same amid all political vicissitudes, came to be described and recognized at various stages in its history. It is difficult at this distance of time to realize how in the far off days, what are now known as Scotland and Ireland, were peopled by Gaels, who owned the same lineage and who spoke an identical language, and between whom there was a constant inter-communion, as if in very truth they lived in one and the same country. All the evidence that is available, and that can be adduced, goes to prove that the Picts were

Gaels—Gaels in language, Gaels in character, and Gaels in their rightful determination to regard Albion as their ancestral home, and to act on the belief, when they fought and put forth their prowess in the strife of arms, that they were in very truth fighting pro aris et focis. Mr. Nicholson, by his indefatigable labours and by his wonderful success in interpreting the Ogam Inscriptions which are to be found, so far as Scotland is concerned, in localities where the Picts are known to have had their homes in the days of old, has done much, and very much, for which he is entitled to receive the gratitude of Gaels everywhere—to furnish corroborative evidence of a very rare and cogent character that the Picts were Gaels, that Albion was the country of their ancestors, that their language and traditions were purely Gaelic, and that their position among the historical peoples of Great Britain and Ireland, is very honourable, by reason of its very antiquity, is illustrious owing to their being the descendants of the earliest Gaelic occupants of those countries, and is henceforth to be acknowledged as the position of a people that was Gaelic in language, in traditions, in country, and in everything that is characteristic of the Scottish Gael of several centuries ago.

THE FUNCTION OF INDIRECT VISION AND THE USE OF COLOURED AND SMOKED EYE GLASSES.

By A. Kirschmann, Ph. D.

(Read April 24th, 1897).

The proposition that the sensibility of the retina decreases from the *fovea centralis* toward the periphery is still seen now and then in text books on Physiological Optics. This statement shows not only a careless misrepresentation of facts which can be observed in our daily experience, and an entire lack of understanding of the extremely elaborate adaptation of this sense organ to the difficult function which it has to perform, but it also involves a logical error, for those who make such a statement either do not see that the retina has different functions to accomplish, thus requiring a special sensibility in each of these functions, or they assume that if the peripheral retina is less sensitive for one quality of the impressions it must be less sensitive for all. They also seem to assume that the conditions which prevail on the eccentric retina are of the nature of an imperfection, or a less complete development.

The negligent way in which indirect vision has hitherto been treated, even in the most celebrated works on Physiological and Psychological Optics, has borne evil fruit of which I may here give a simple example. In Germany they are about to replace the customary German type with the Roman, on the ground that the latter has simpler forms and can therefore be more easily distinguished. This contention contains the silent assumption that all reading is done by means of direct vision, that is, that all single letters are successively projected on the *fovea centralis*. This, however, is not at all the case, for we do not let the fixation point wander from letter to letter as a child does in its first reader, but the fixation point jumps from word to word, fixing in each a letter at random and seeing all others indirectly. (This circumstance accounts also for the fact that we overlook mistakes in printing so easily, especially when the subject matter is familiar to us). Thus we see that reading does not require direct vision only, but it depends even for the greater part on indirect vision. In fact, with indirect vision alone with a little practice we could manage to read tolerably well, but

with direct vision alone the reading could never exceed a slow spelling of the letters. Hence, if we speak of the use of certain kinds of type we have to ask not only which forms are the most easily recognized when viewed directly, but we have also to examine at what distance from the fixation point they can be recognised. Some rough trials which I made some time ago showed that the Roman capitals with their marked simple geometrical configuration are decidely superior to the peculiarly shaped German capitals. But, on the other hand, the small German letters, although they are more complicated in their forms, seem to be, on account of their marked prominences, and their cornered appendices above and below the line, superior to the Roman letters. The latter are too much rounded and at a short distance from the centre nearly all look alike. Further, in the German letters, the different forms of "s" at the end and at the beginning of root syllables and special combinations for "st" and "sz" give greater variability. It seems to me also, that the repetition of forms in the small Roman letters is too great, "b," "d," "p" and "q" are exactly the same form placed in the four quadrants of rectangular co-ordinates, in a plane.

The above misrepresentations concerning the function of indirect vision have their origin with those Scientists, who in trying to make the results of Science digestible to the public, are inclined to state everything as "explained." As a consequence of this, things which are not understood are very often said to be imperfect. Such has certainly been the case when the "imperfection" and "inferior development" of the eccentric retina are spoken of. Some even go so far as to say that the peripheral retina is undeveloped because of a lack of exercise of its activities. Those holding this view do not see that it is very questionable whether an eye whose retina had not the difference between direct and indirect vision would be more serviceable than one which had these differences. I think such an eye would be a very imperfect sense organ, and this is in accordance with the general principle which is observed everywhere in nature—viz: The higher an organism is developed the more the qualitative division of labour is applied in its constituents. In certain cases we seem to find a deviation from this principle in higher organisms, for example, in the fact that we have two eyes; but a closer examination will show that this same principle is fundamental in these cases also. Binocular vision is not for the purpose of securing twice as much light intensity as one eye could give. This is clearly proven by Fechner's paradox experiment, which shows that when one eye sees the full light, the intensity of the sensation is *diminished* when a certain amount is

added from the other eye. Further, the function of Binocular vision is not especially to increase the vision field ; it is rather for the purpose of seeing objects from two different standpoints.

The principle of the qualitative division of labour is, however, directly demanded by the general constitution of consciousness. The facts of consciousness at any time are not all equally prominent, for while all sensations present are *perceived*, only a very limited number are *apperceived*, that is, but few are in the "gravitation point" of our attention. Since sensations of sight play the foremost rôle in the presentational side of mental life it is almost imperative that the manifoldness of light impressions given at any moment should conform to this general constitution. We might, therefore, assume *a priori* that a highly developed visual organ cannot have an arrangement of its elements like the facetted eyes of the insects (which are a striking case of quantitative division of labour), but rather an arrangement in which each element is to perform its functions in a way different from the other elements. We may then expect that the central part of the retina will be superior to the peripheral regions in some respects and inferior in others.

Our sense of sight has to apprehend brightness, (light intensity), colour quality, space configuration (shape and size), and changes of the latter, *i.e.*, movement. It is well known that eccentric is far inferior to central vision in the distinction of discrete points and the perception of spacial forms, and also it is known that the manifoldness of colour qualities gradually decreases with the approach to the periphery until a zone is reached in which no colours are perceived at all. It must be noticed, on the other hand, that in the detection of movement, indirect is far superior to direct vision. This is the reason that moving objects so easily draw our attention, even when the objects are small and the movement slow. The most striking case of the superiority of indirect vision, however, is found in its greater sensitiveness to light intensity. In this case indirect vision is physically at a certain disadvantage as compared with direct vision. If we have a number of lights of equal brightness at equal distance from the eye, but in different parts of the vision field, the retina images of them will not be of equal brightness, but will be brighter the nearer they are to the *fovea centralis*, for the light which becomes effective in each case is a pencil of rays whose angular value is measured by the projection of the pupil on the plane which is normal to the incidence, in other words the intensity of the retinal image is proportional to the cosine of the angle of incidence. The more oblique these cones stand in relation to the pupil the less light

they represent. Thus we see that physically considered the eccentric retina receives less light than the central part, and yet we do not notice anything of this deficiency. If we look at a uniformly illuminated surface it does not appear to us as it should according to the optical nature of the retinal image, that is, darker at the edges and brighter in the centre, but it appears uniformly bright. On closer examination it has been shown that the light intensity becomes even a trifle greater toward the periphery. Thus the eccentric retina, as compared with the centre, seems to have a greater sensitiveness to light, which not only makes up for the physical decrease in the brightness of the retinal image, but even over-compensates the latter a little. This over-compensation has been experimentally ascertained by myself for ordinary conditions of illumination,* and in the case of adaptation for the dark by Dr. A. E. Fick.† Now this over-compensation is by no means an accidental affair, as its high proportionate value proves, it certainly serves a certain purpose. Our eye is not only a most accurate optical apparatus, but it is also a motory mechanism of the highest precision. Motion is of the very nature of the eye, and the qualitative division of labour of the different parts of the retina, to which corresponds the gradual differentiation of indirect vision from the fixation point outwards, seems to be established chiefly with regard to these motor functions. As a rule we pay attention to that part of the vision field whose image is projected on the *fovea centralis* and its immediate surroundings. To this fact Wundt has given the name "coincidence of apperception and fixation." This rule, however, is transgressed in every case in which we give our attention to a point in indirect vision, or, in other words, whenever we change the direction of our attention. Whenever a change of light intensity or of space configuration occurs in indirect vision there is a tendency to bring the new impression into the fixation point. This function of the visual organ will be more perfectly carried out the more prompt the peripheral regions of the retina react. Thus the greater sensitiveness of indirect vision will not only foster the efficiency of the motory mechanism of the eye, but it will, so to say, condition it. It is, therefore, the greater sensitiveness of the eccentric regions of the retina for light intensity and movements, which makes the eye respond so readily to even the slightest changes in configuration or brightness occurring in eccentric parts of the vision field.

We, therefore, recognize on the one hand, the superiority of the

*Kirschmann—Die Helligkeits Empfindung in Indirecten—Sehen. Philosophische Studien, Vol. V., p. 417ff.

†A. E. Fick—Studien uber Licht und Farben Empfindungen. Pfluger's Archiv, Vol. 43, p. 441ff.

central retina for the perception of forms and colours, and on the other the superiority of the eccentric retina in sensitiveness to light and to changes in space. These supplement each other to make the eye what it is, and injury to either is equally harmful to the efficiency of the sense of sight. The peripheral retina *must* be more sensitive to light, and if we prevent it from exercising this function we will injure the motory mechanism in the most vital way. Such injuries will be induced by all those artificial optical arrangements which give advantages of any kind to direct vision at the expense of the light intensity offered to indirect vision. All kinds of smoked and blue or otherwise coloured glasses which absorb the rays destined for direct and indirect vision in unequal ratio, must be classed as harmful arrangements of this character This is especially the case with concave glasses which are smoked or coloured throughout. The rays which are transmitted through the centre of these glasses to the central regions of the retina suffer less absorption than those rays which, coming from the side, have to pass through a considerably greater extent of absorbing medium. The indirect vision in this case, is, therefore, at a disadvantage, and its movement-inducing function will be greatly damaged, for the peripheral parts do not get the necessary amount of light to give the characteristic impulses for directing the eye towards the objects concerned. Therefore *concave glasses which are coloured throughout should* NEVER BE USED, *aud the prescription and sale of them should be prohibited.* If, however, correction of the refractive state of the eye, and protection against high intensities are required at the same time, the two conditions should either be met by separate glasses, or, if this be impracticable, the glasses should not be coloured throughout, but should be composed (after the manner of achromatic lenses), of a perfectly colourless concave part of the proper refraction power, and a coloured part with parallel surfaces, having the refractive power zero.